(12) UK Patent Application (19) GB (11) 2 236 089 (13) A

(43) Date of A publication 27.03.1991

(21) Application No 9007005.3

(22) Date of filing 29.03.1990

(30) Priority data
(31) 8923544 (32) 19.10.1989 (33) GB

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(51) INT CL[5]
B65D 30/24, B01F 5/00, B28C 5/02, B65D 88/54 88/76 E21D 11/10, E21F 15/04

(52) UK CL (Edition K)
B8K KFA K2G5 K2K4 K2K6 K2L K2V
B1C CAU C121 C2012
B2F FHD F105 F209 F323 F347
E1E E1D
U1S S1247 S1263 S1456 S1607 S1697 S1759

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(58) Field of search
UK CL (Edition K) B2F FD FFD FHA FHD, B8K KAB KFA KFC KH, E1E
INT CL[5] B05B, B05C, B65D, E21D, E21F
Online database: WPI

(54) **Containment bags used in monolithic packing system etc**

(57) A closed plastics containment bag (1), for receiving a cement mix(es) (2) as part of a monolithic pump packing system for strata control, during mineral winning such as coal mining (see Figs 5, 6 not shown), has at least one plastics lay-flat filling tube (8), secured to the bag (1) and communicating at an inner end (10) of the tube (8) with the bag interior (11). The tube inner end (10) constitutes a non-return valve; and the bag has suspension hooks (12) attached via plastics pads (13) welded to the bag, for hooking onto a previously filled bag. Apparatus for filling the bag comprises a filling nozzle (15) having an outlet aperture (16) for at least one flowable medium or mix, the aperture opening at an intermixing zone (17) comprising turbulance-inducing baffles (18) supported from an elongate open frame (19). The frame (19) is inserted into the bag's filling tube (8) and the mixed cement is pumped into the bag.

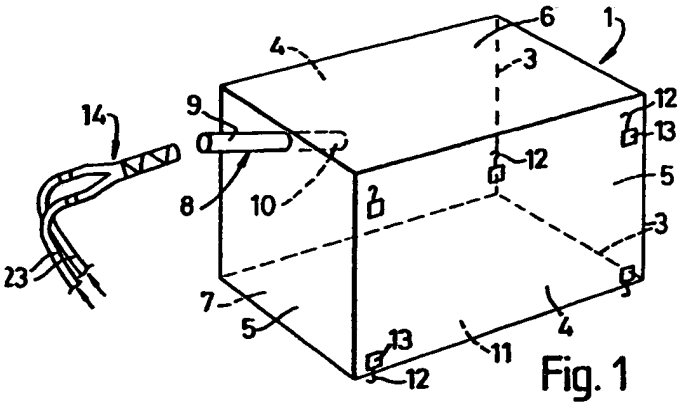

Fig. 1

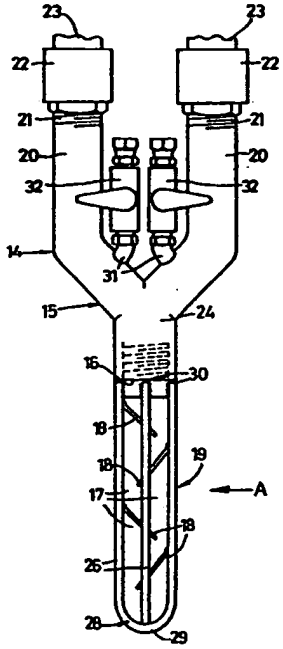

Fig. 2

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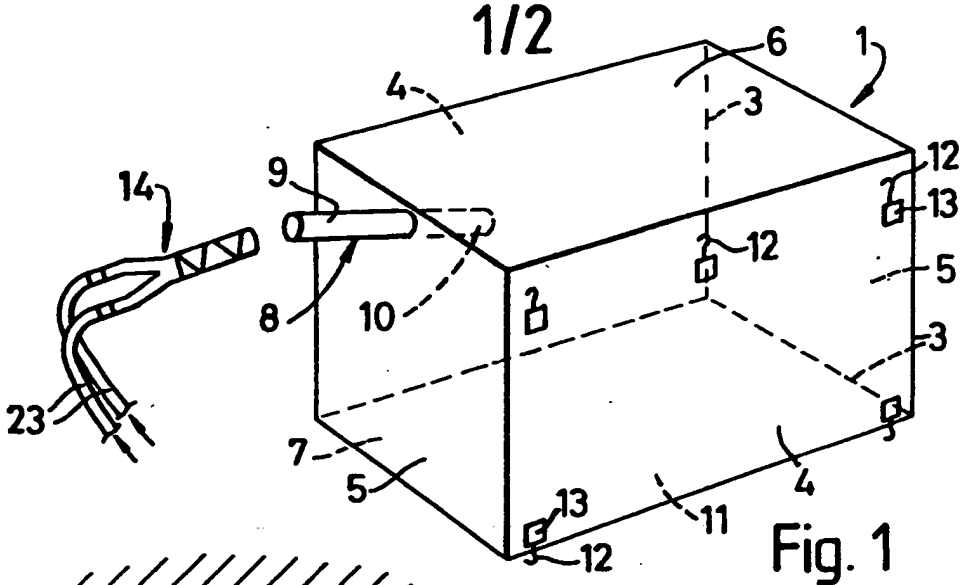

Fig. 1

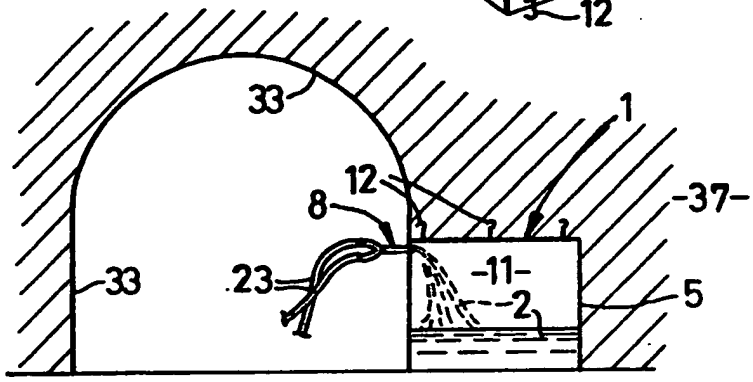

Fig. 5

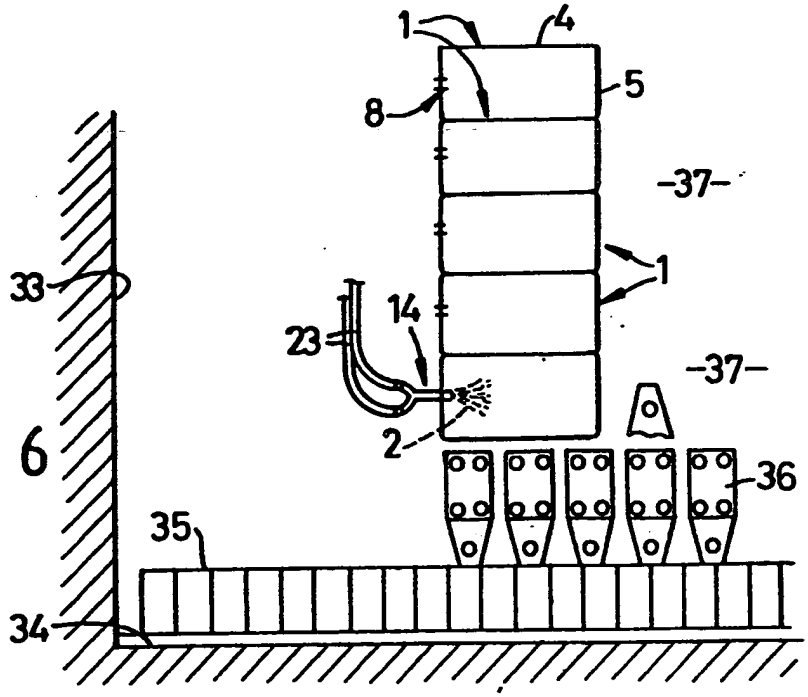

Fig. 6

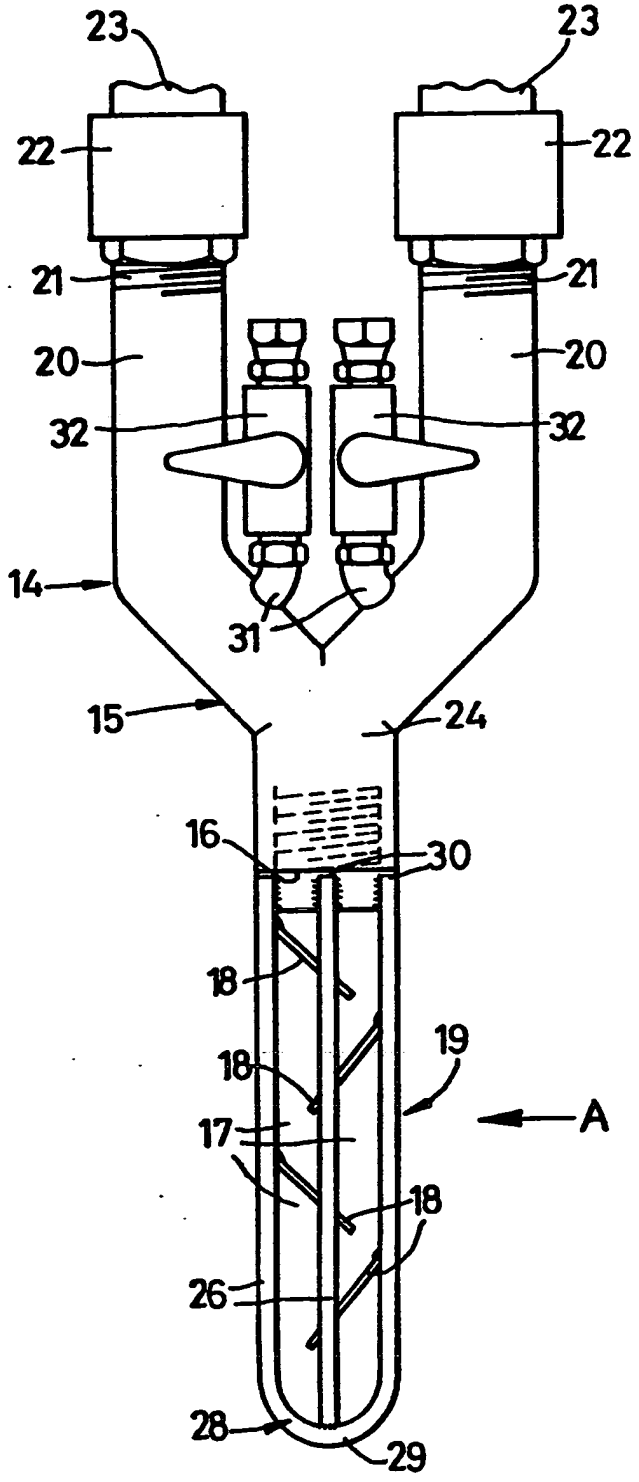

Fig. 2

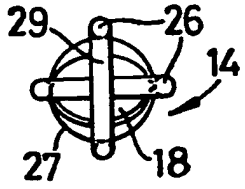

Fig. 4

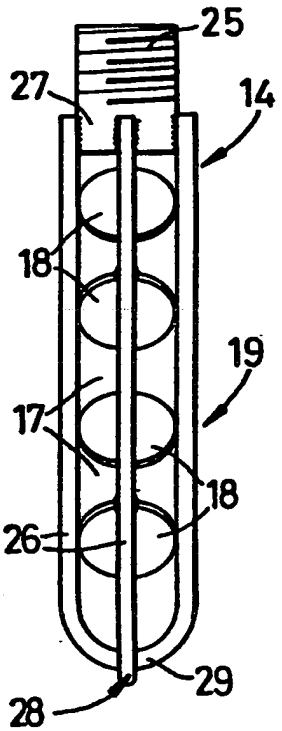

Fig. 3

MONOLITHIC PACKING SYSTEM ETC.

This invention relates to aspects of a monolithic packing system as is used extensively in the building of packs in the goaf areas to each side of a mine roadway for strata control purposes, during mineral winning operations, such as coal mining, or indeed in any situation where a cavity is required to be filled, e.g. in civil engineering construction work.

Conventionally, bags of PVC with polyester or nylon reinforcement, are provided with two filling tubes for two cement/water mixes of approximately 80% water, leading to a mixing zone within the bag with the two cements reacting when brought together, and in the packing of goaf areas, for example, the bags are laid or stacked in position in the goaf, before filling, by a pumping system. The quality of the packs built up from such bags is dependent upon proper and adequate intermixing of the two cement mixes, which to a very large extent depends on the skill and care of the operator, and inevitably intermixing of inconsistent quality occurs - leading to constructions of packs of poor quality and hence poor strata control, resulting in additional roadway maintenance requirements, disruption of pack filling leads to disruption of pack construction and could lead to disruption of mineral production - or even intermixing of quite unacceptable quality results, to the extent that filled bags are quite unusable and hence represent costly waste.

According to a first aspect of the present invention,

there is provided a containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, the bag being of synthetic plastics material and being closed, having at least one lay-flat filling tube, also of synthetic plastics material, secured to the bag and communicating at an inner end of the tube with the bag interior.

Although a single filling tube would normally be sufficient in some instances an additional filling tube(s) may be fitted to make access more convenient and to give a choice of filling points.

The synthetic plastics material is preferably reinforced PVC sheeting, while the bag is preferably constructed to parallepiped form, closed by suitably welded seams. The or each filling tube preferably extends into the bag interior to constitute a non-return valve. The bag is also preferably provided with a plurality of external suspension hooks attached to at least one wall of the bag. Conveniently, hook attachment is via a synthetic plastics attachment pad welded to the external wall at a required location. Preferably the hooks are attached externally to a side wall of the bag, while the filling tube passes through an end wall of the bag or the top of the bag near to one end wall. In detail, three or more spaced-apart hooks may be attached adjacent the upper edge of the side wall and two-spaced apart hooks adjacent the lower edge of the side wall. The bags may be of any size but normally vary between say 4m x 3m x 1.5m to 1.2m x 1.2m x 1m.

According to another aspect of the invention, there is provided apparatus for filling a bag as defined above, comprising a filling nozzle having an outlet aperture for at least one flowable medium or mix with which the bag is to be filled, the outlet aperture opening at an intermixing zone comprising a plurality of turbulance-inducing baffles supported from an elongate, openwork frame.

According to yet another aspect of the invention, there is provided apparatus as defined above, in combination with a filling tube into one end of which the elongate open frame is adapted to be inserted for the discharge of at least one flowable medium or mix from the other end of the tube, whereby the apparatus is capable of filling cavities without the use of a bag, and/or for filling bags not themselves provided with a filling tube.

According to yet another aspect of the invention, there is provided a method of filling a bag in accordance with the first aspect, by appartus in accordance with the second aspect, comprising inserting the frame of the apparatus into the, or a selected, filling tube of the bag, pumping at least two flowable media or mixes to the apparatus, and effecting intimate intermixing of the two media or mixes by the baffles within the filling tube, with continued pumping in of fresh media or mixes forcing the discharge of intermixed media from the filling tube, into the interior of the bag.

Thus, with the bag, apparatus and filling method in accordance with the invention, intermixing is effected before discharge into the bag, in contrast to the prior art technique

whereby intermixing was intended to be effected inside the bag with a relatively unknown and uncontrolled degree of success. On the other hand, with the proposal of the invention, and for the filling of bags with two different cement/water mixes intended to react when intermixed, the two sources of media are positively forced past the baffles by pressure of succeeding material arriving from the pump and hence their intimate mixing is guaranteed, before discharge either from a terminal end of the frame, or through apertures in the side of the frame. Tests have shown that with the bags, apparatus and method of the invention, a 30% better performance is achieved than by prior art techniques, due to the superior intermixing that occurs, and the mix consistency that results, providing for optimum cement setting times and better roadway support.

In detail, the apparatus may comprise a pair of connector pipes one for connection to each of two sources of pumpable cement mixes. Preferably, a terminal end of each pipe is threaded externally to receive a screwed-on connection, preferably including a non-return valve from a supply pipe from the pump. At their other ends, the two connector pipes merge at a common throat having a discharge aperture and which is internally threaded, to receive an externally threaded spigot of the frame, so that, in use, partially mixed cement exits the discharge aperture into the frame. The latter is preferably generally tubular and of dimensions to fit comfortably within the bag filling tube, and is fabricated from heavy gauge, e.g. 8 mm, wire. In detail,

the frame may comprise four longitudinally extending wires located 90° apart extending from a short length of tube, which constitutes the spigot, to a terminal end of the frame remote from the spigot. Preferably, a single length of wire is provided at its mid-length with a 180° arcuate bend, to provide two longitudinal wires. The wire ends at the spigot are conveniently secured by welding to the spigot. The baffles may be disc-like and angled, e.g. at 45° or thereabouts to the longitudinal axis of the frame. In detail, a frame of say 280 mm length may be provided with four baffles, arranged in herringbone fashion, with two baffles welded to one longitudinal wire and two to the longitudinal wire 180° away.

The connector pipes are conveniently 1.1/2" BSP and each is preferably provided with a water supply connection, and with an on/off valve, for water flushing after the completion of bag filling operations. It will be appreciated that, after the completion of bag filling operations, the frame is removed from the tube, and cement mix adhering to the frame or baffles is removed, simply by knocking the cage on the ground, so that the loosened particles of cement mix fall through the interstices of the cage.

The apparatus may be provided with a handle, e.g. a simple "U"-shaped weld-on handle, for ease of transport and/or man-handling of the apparatus.

The various aspects of the invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a view of a containment bag in accordance with the first aspect of the invention;

Figure 2 is a side elevation of apparatus in accordance with the second aspect;

Figure 3 is a view of part of Figure 2 in the direction of arrow A,

Figure 4 is an end elevation of Figure 3,

Figure 5 illustrated the containment bag of Figure 1 in situ and being filled by the apparatus of Figures 2 and 3, by being an axial view along the mine roadway, and

Figure 6 is a plan view of Figure 5.

In Figure 1 is illustrated a containment bag 1 for receiving a cement mix 2 (Figure 5) as part of a monolithic pump packing system from strata control. The bag 1 is constructed from, preferably reinforced PVC sheeting, constructed to parallepiped form closed by suitably welded seams 3, so as to have two side walls 4, two end walls 5, and a top wall 6 and a bottom wall 7, so that the bag 1 is closed apart from a single, lay-flat filling tube 8, also of synthetic plastics material, secured to the end wall 5, with an outer end 9 projecting from the bag 1 and with an inner end 10 with the bag interior 11, and constituting a non-return valve. One or both side walls 4 of the bag is/are provided with a plurality of external suspension hooks 12 attached via a synthetic plastics attachment pad 13 welded externally to the side wall 4 at required locations. Three spaced-apart hooks 12 are illustrated attached adjacent the upper edge of the side wall 4 and two-spaced apart hooks adjacent the lowr

edge of the side wall 4. The bags 1 may vary in size between say 4m x 3m x 1.5m to 1.2m x 1.2m x 1m.

In Figures 2 to 4 is illustrated in detail apparatus 14 for filling a bag 1 as described above, with cement mix 2, via the tube 8. The apparatus 14 comprises a filling nozzle 15 having an outlet aperture 16 for the concrete mix with the outlet aperture 16 opening at an intermixing zone 17 comprising a plurality of turbulance-inducing baffles 18 supported from an elongate, openwork cage or frame 19. The apparatus 16 further comprises a pair of connector pipes 20 one for connection to each of two sources of pumpable cement mixes. A terminal end of each pipe 20 is threaded externally at 21 to receive a screwed-on connection 22, including a non-return valve, from a supply pipe 23 from a pump (not shown). At their other ends, the two connector pipes 20 merge at a common throat 24 constituting a discharge tube the terminal end of which constitutes the discharge aperture 16. The throat 24 is internally threaded, to receive an externally threaded spigot 25 of the frame 19, so that, in use, partially mixed cement exits the discharge aperture 16 into the frame 19. The latter is preferably generallty tubular and of dimensions to fit comfortably within the bag filling tube, and is fabricated from heavy gauge, e.g. 8mm wire. In detail, the cage comprises four longitudinally extending wires 26 located 90° apart extending from a short length of tube 27, which constitutes the spigot 25, to a terminal end 28 of the frame of cage 19 remote from the spigot 25. A single length of wire is provided at its mid-length with a 180° arcuate bend

29, to provide two longitudinal wires. The wire ends 30 at the spigot are secured by welding to the tube 27. The baffles 18 are disc-like and angled, e.g. at 45° or thereabouts to the longitudinal axis of the cage or frame 19. For instance, a frame 19 of say 280mm length may be provided with four baffles 18, arranged in herringbone fashion, with two baffles 18 welded to one longitudinal wire 26 and two to the longitudinal wire 26 180° away. The connector pipes 20 are conveniently 1.1/2" BSP and each is provided with a water supply connection 31 and with an on/off valve 32 for water flushing after the completion of bag filling operations.

Bags 1 are filled, and hence the packing system operated as follows.

In Figures 5 and 6, are diagrammatically illustrated a mine roadway 33, a mineral face 34, a face conveyor 35 and roof supports 36 which advance, as the face 34 advances during mining operations, with the mine roof being allowed to cave in goaf area 37 behind the supports 34. Strata control adjacent the roadway 33 is assisted by the construction of a support pack to preclude caving immediately adjacent the roadway 34. In detail, bags 1 are transported to site in a flat condition and one sidewall 4 is hooked onto a suitable support structure e.g. a previously filled bag. The frame 19 is then inserted into the filling tube 8 and the pump switch on so that cement, mixed in the frame 19, principally by the baffles 18, is discharged via the tube 8 into the bag interior, as illustrated in Figure 5. Eventually, upon rise of the filling to a sufficient level, the inner end 10 of the tube 8

is immersed in concrete and is therefore urged closed, when pumping is halted upon the bag being completely filled. It will be appreciated that, after the completion of bag filling operations, the frame 19 is removed from the tube 8, and cement mix adhering to the frame 19 or baffles 18 is removed, simply by knocking the frame 19 on the ground, so that the loosened particles of cement mix fall through the interstices of the frame 19.

CLAIMS

1. A containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, the bag being of synthetic plastics material and being closed, having at least one lay-flat filling tube, also of synthetic plastics material, secured to the bag and communicating at an inner end of the tube with the bag interior.

2. A containment bag as claimed in Claim 1, wherein the synthetic plastics material is reinforced PVC sheeting.

3. A containment bag as claimed in Claim 2, wherein the bag is constructed to parallepiped form, closed by suitably welded seams.

4. A containment bag as claimed in any one of Claims 1 to 3, wherein the or each filling tube extends into the bag interior to constitute a non-return valve.

5. A containment bag as claimed in any one of Claims 1 to 4, provided with a plurality of external suspension hooks attached to at least one wall of the bag.

6. A containment bag as claimed in Claim 5, wherein hook attachment is via a synthetic plastics attachment pad welded to the external wall at a required location.

7. A containment bag as claimed in Claims 5 or 6, wherein the hooks are attached externally to a side wall of the bag.

8. A containment bag as claimed in any one of Claims 5 to 7, wherein the filling tube passes through an end wall of the bag or through the top of the bag means to an end wall.

9. A containment bag as claimed in Claim 3 and any Claim appendant thereto with the bag of dimensions between 4m x 3m x 1.5m to 1.2m x 1.2m x 1m.

10. A containment bag as claimed in any one of Claims 5 to 9, comprising three or more spaced-apart hooks adjacent the upper edge of the sidewall and two spaced-apart hooks adjacent the lower edge of the sidewall.

11. A containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

12. Apparatus for filling a containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, comprising a filling nozzle having an outlet aperture for at least one flowable medium or mix the outlet aperture opening at an intermixing zone comprising a plurality of turbulance-inducing baffles supported from an elongate, openwork frame.

13. Apparatus as claimed in Claim 12, comprising a pair of connector pipes one for connection to each of two sources of pumpable cement mixes.

14. Apparatus as claimed in Claim 12 or Claim 13, wherein a terminal end of each pipe is threaded externally to receive a screwed-on connection.

15. Apparatus as claimed in Claim 14, wherein each connection includes a non-return valve from a supply pipe from the pump.

16. Apparatus as claimed in any one of Claims 13 to

15, wherein at their other ends, the two connector pipes merge at a common throat having a discharge aperture and which is internally threaded, to receive an externally threaded spigot of the frame, so that, in use, partially mixed cement exits the discharge aperture into the frame.

17. Apparatus as claimed in any one of Claims 12 to 16, wherein the frame is generally tubular.

18. Apparatus as claimed in any one of Claims 12 to 17, wherein the frame is fabricated from heavy gauge, e.g. 8 mm wire.

19. Apparatus as claimed in Claim 18, wherein the frame comprises four longitudinally extending wires located 90o apart extending from a short length of tube, which constitutes the spigot, to a terminal end of the frame remote from the spigot.

20. Apparatus as claimed in Claim 19, wherein a single length of wire is provided at its mid-length with a 180o arcuate bend, to provide two longitudinal wires.

21. Apparatus as claimed in Claim 20, wherein the wire ends at the spigot are secured by welding to the spigot.

22. Apparatus as claimed in any one of Claims 12 - 21, wherein the baffles are disc-like and angled, e.g. at 45o or thereabouts, to the longitudinal axies of the frame.

23. Apparatus as claimed in any one of Claims 12 to 22, wherein a frame of 280 mm length is provided with four baffles, arranged in herringbone fashion, with two baffles welded to one longitudinal wire and two to the longitudinal wire 180o away.

24. Apparatus as claimed in any one of Claims 12 to 23, wherein the connector pipes are 1.5" B.S.P.

25. Apparatus as claimed in any one of Claims 12 to 24, wherein each connector pipe is provided with a water supply connection.

26. Apparatus as claimed in Claim 25, wherein each water supply connection is provided with an on-off valve.

27. Apparatus as claimed in any one of Claims 12 to 26, in combination with a filling tube into one end of which the elongate open frame is adapted to be inserted for the discharge of at least one flowable medium or mix from the other end of the tube.

28. Apparatus as claimed in Claim 12 and substantially as hereinbefore described with reference to Figures 2 to 4 of the accompanying drawings.

29. A method of filling a containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, by apparatus in accordance with any one of Claims 12 to 27 comprising inserting the frame of the apparatus into a filling tube of the bag, pumping at least two flowable media or mixes to the apparatus, and effecting intimate intermixing of the two media or mixes by the baffles within the filling tube, with continued pumping in of fresh media or mixes forcing the discharge of intermixed media from the infill tube, into the interior of the bag.

30. A method of filling a bag as claimed in Claim 29, and substantially as hereinbefore described with reference to the accompanying drawings.

Amendments to the claims have been filed as follows

1. Apparatus for filling a containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, comprising a filling nozzle having an outlet aperture for at least one flowable medium or mix the outlet aperture opening at an intermixing zone comprising a plurality of turbulance-inducing baffles supported from an elongate, openwork frame.

2. Apparatus as claimed in Claim 1, comprising a pair of connector pipes one for connection to each of two sources of pumpable cement mixes.

3. Apparatus as claimed in Claim 1 or Claim 2, wherein a terminal end of each pipe is threaded externally to receive a screwed-on connection.

4. Apparatus as claimed in Claim 3, wherein each connection includes a non-return valve from a supply pipe from the pump.

5. Apparatus as claimed in any one of Claims 2 to 4, wherein at their other ends, the two connector pipes merge at a common throat having a discharge aperture and which is internally threaded, to receive an externally threaded spigot of the frame, so that, in use, partially mixed cement exits the discharge aperture into the frame.

6. Apparatus as claimed in any one of Claims 1 to 5, wherein the frame is generally tubular.

7. Apparatus as claimed in any one of Claims 1 to 6, wherein the frame is fabricated from heavy gauge, e.g. 8 mm wire.

8. Apparatus as claimed in Claim 7, wherein the frame comprises four longitudinally extending wires located 90° apart extending from a short length of tube, which constitutes the spigot, to a terminal end of the frame remote from the spigot.

9 Apparatus as claimed in Claim 8, wherein a single length of wire is provided at its mid-length with a 180° arcuate bend, to provide two longitudinal wires.

10. Apparatus as claimed in Claim 9, wherein the wire ends at the spigot are secured by welding to the spigot.

11. Apparatus as claimed in any one of Claims 1 - 10, the baffles are disc-like and angled, e.g. at 45° or thereabouts, to the longitudinal axies of the frame.

12. Apparatus as claimed in any one of Claims 1 to 11, wherein a frame of 280 mm length is provided with four baffles, arranged in herringbone fashion, with two baffles welded to one longitudinal wire and two to the longitudinal wire 180° away.

13. Apparatus as claimed in any one of Claims 1 to 12, wherein the connector pipes are 1.5" B.S.P.

14. Apparatus as claimed in any one of Claims 1 to 13, wherein each connector pipe is provided with a water supply connection.

15. Apparatus as claimed in Claim 14, wherein each water supply connection is provided with an on-off valve.

16. Apparatus as claimed in any one of Claims 1 to 15, in combination with a filling tube into one end of which the elongate open frame is adapted to be inserted for the

discharge of at least one flowable medium or mix from the other end of the tube.

17. Apparatus as claimed in Claim 1 and substantially as hereinbefore described with reference to Figures 2 to 4 of the accompanying drawings.

18. A method of filling a containment bag for receiving a cement mix(es) as part of a monolithic pump packing system for strata control, by apparatus in accordance with any one of Claims 1 to 16 comprising inserting the frame of the apparatus into a filling tube of the bag, pumping at least two flowable media or mixes to the apparatus, and effecting intimate intermixing of the two media or mixes by the baffles within the filling tube, with continued pumping in of fresh media or mixes forcing the discharge of intermixed media from the infill tube, into the interior of the bag.

19. A method of filling a bag as claimed in Claim 18, and substantially as hereinbefore described with reference to the accompanying drawings.

20. The use of a containment bag for carrying out the method of Claim 18 or 19, the bag being of synthetic plastics material and being closed, having at least one lay-flat filling tube, also of synthetic plastics material, secured to the bag and communicating at an inner end of the tube with the bag interior.

21. The use of a containment bag as claimed in Claim 20, wherein the synthetic plastics material is reinforced PVC sheeting.

22. The use of a containment bag as claimed in Claim

21, wherein the bag is constructed to parallepiped form, closed by suitably welded seams.

23. The use of a containment bag as claimed in any one of Claims 20 to 22, wherein the or each filling tube extends into the bag interior to constitute a non-return valve.

24. The use of a containment bag as claimed in any one of Claims 20 to 23, provided with a plurality of external suspension hooks attached to at least one wall of the bag.

25. The use of a containment bag as claimed in Claim 24, wherein hook attachment is via a synthetic plastics attachment pad welded to the external wall at a required location.

26. The use of a containment bag as claimed in Claims 24 or 25, wherein the hooks are attached externally to a side wall of the bag.

27. The use of a containment bag as claimed in any one of Claims 24 to 26, wherein the filling tube passes through an end wall of the bag or through the top of the bag means to an end wall.

28. The use of a containment bag as claimed in Claim 22 and any Claim appendant thereto with the bag of dimensions between 4m x 3m x 1.5m to 1.2m x 1.2m x 1m.

29. The use of a containment bag as claimed in any one of Claims 24 to 28, comprising three or more spaced-apart hooks adjacent the upper edge of the sidewall and two spaced-apart hooks adjacent the lower edge of the sidewall.

30. The use of a containment bag for receiving a

cement mix(es) as part of a monolithic pump packing system for strata control, substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

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